

Amendments to the Drawings

The attached sheets of drawings include new Figures 5 and 6.

Attachment: New Sheets

REMARKS

I. INTRODUCTION

The Office Action mailed on September 7, 2006 and April 19, 2006 and the references cited therein have been carefully studied and, in view of the following amendments and remarks, reconsideration and allowance of this application are most respectfully requested. Claims 1-34 are currently pending in the present application, and claims 1-34 have been rejected. By the current amendment, the specification has been amended and claims 4 and 5 have been amended. It is believed that no new matter has been added by the current amendment. Reconsideration of the subject patent application in light of the present remarks is respectfully requested.

II. OBJECTIONS TO DRAWINGS UNDER 37 C.F.R. 1.83(a)

Figures 5 and 6 and new paragraphs [0065] and [0066] have been added to the specification. Figure 5 shows an embodiment of Applicant's invention wherein the optoelectronic device includes a wetting layer deposited over the first electrode and a planarizing layer deposited over the second layer. Figure 6 shows an embodiment of Applicant's invention wherein the optoelectronic device includes an electron-hole recombination zone deposited over the second layer, a third layer deposited over the electron-hole recombination zone, and a fourth layer deposited over the third layer.

Applicants respectfully submit that new paragraphs [0065] and [0066] do not add new matter. More specifically, paragraph [0060]-[0061] teaches a planarizing and wetting layer described in new paragraph [0065] and shown in Figure 5, and paragraph [0062] teaches an electron-hole recombination zone described in new paragraph [0066] and shown in Figure 6. Applicants respectfully submit that the foregoing amendments do not add new matter and the objection to the drawings should be withdrawn.

III. REJECTIONS UNDER 35 U.S.C. § 112

Claims 4 and 5 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as their invention.

Specifically, claims 4 and 5 stand rejected because it is maintained that the surface area-to-volume ratio “can never be a dimensionless quantity” and that it “can be set to any arbitrary value.” As currently amended, claims 4 and 5 recite the limitation that the surface area and volume are measured in micrometers. Thus, claims 4 and 5 as amended recite a ratio that may be quantified and not “set to any arbitrary value.” Applicants respectfully submit that these amendments to claims 4 and 5 do not add new matter. As can be seen in Figures 3(a), 3(b), and 3(c), the protrusions in the organic layer may be measured in micrometers (or microns).

Thus, Applicants respectfully submit that the rejections under 35 U.S.C. § 112, second paragraph, have been overcome and should therefore be withdrawn.

IV. REJECTIONS UNDER 35 U.S.C. § 102(e)

Claims 1-5, 8-11, 17-19, 23-26, and 33-34 stand rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent Publication No. 2004/0121508 (“Foust”). It is respectfully submitted that these rejections should be withdrawn for at least the following reasons.

To anticipate a claim, the reference must disclose each and every element of the claimed invention. *Verdergaal Bros. v. Union Oil Co. of Cal.*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987). Applicants respectfully submit that Foust does not disclose or suggest each and every element of these claims.

Foust is directed to large organic devices and methods of fabricating such devices. The devices and methods taught by Foust use a flexible and rigid plastic substrate. However, Foust does not teach or disclose a bulk heterojunction. In contrast, Applicants disclose and claim a method for fabricating a device having a bulk heterojunction.

Independent claims 1 and 17 each claim an optoelectronic device having a bulk heterojunction. Claims 4-5, 8-11, 18, 19, 23-26, and 33-34 ultimately depend from these independent claim and therefore include this element.

A heterojunction is the interface of two materials and in a photovoltaic (PV) device, the materials are selected for their conductive properties to facilitate charge separation for excitons created within an exciton diffusion length of the interface. *See* specification para. [0026]. Bulk heterojunction devices, as understood by one skilled in the art, are characterized by an interpenetrating network of donor and acceptor materials, providing a large interface surface area where photoinduced charge transfer by excitons into separated electrons and holes can efficiently occur. The interface in a bulk heterojunction taught by Applicants may be characterized as being “highly folded” such that it has a relatively high surface area-to-volume ratio. It is believed that “[b]y increasing this surface area-to-volume ratio, the exciton dissociation probability, and hence the efficiency, of the fabricated optoelectronic device are increased.” *See* specification paras. [0029] and [0038].

The Examiner believes that the method taught by Foust would inherently form protrusions because organic compounds and other layers have some roughness wherein the first layer tends to adhere to itself. *See* Sept. 7, 2006 Office Action para. 8. Applicants respectfully submit that such inherent “protrusions” do not disclose or teach the bulk heterojunctions taught by Applicants. The protrusions described by Applicants, i.e. the protrusions of the first organic layer, are not due to “some roughness” in organic compounds but are instead the results of deliberate design to employ conditions such that Stranski-Krastanov layer-plus-island growth occurs. This growth regime fosters the deposition of a first layer, comprising the first organic small molecule material, having a sufficiently high surface area-to-volume ratio to form the bottom layer of a bulk heterojunction. *See* specification paras. [0041] - [0042]. And, as mentioned above, the increase in surface area-to-volume ratio is believed to increase device efficiency. *See* specification para. [0038].

Applicants believe that small-molecule bulk heterojunctions had not been successfully fabricated using OVPD prior to this invention. Polymer bulk heterojunctions had previously been fabricated by spin coating (see specification paras. [0027] and [0029]) and small molecule bulk heterojunctions had been fabricated by co-deposition and annealing with physical confinement to create phase separation. However, as explained in paragraphs [0030]-[0031] of the present specification, bulk heterojunctions in small molecular systems had been largely unsuccessful.

Thus, for at least the preceding reasons, Applicants respectfully submit that Foust does not anticipate claims 1-5, 8-11, 17-19, 23-26, and 33-34 in this application.

Claims 1-2, 7, 9-13, 22, 25-28, and 33-34 stand rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent No. 6,995,445 ("Forrest I"). It is respectfully submitted that these rejections should be withdrawn.

The Forrest I patent teaches an organic photosensitive detector which may be fabricated using OVPD. However it doesn't teach or disclose the bulk heterojunction taught and claimed by Applicants. Independent claims 1 and 17 each claim an optoelectronic device having a bulk heterojunction. Claims 4-5, 8-11, 18, 19, 23-26, and 33-34 ultimately depend from these independent claim and therefore include this element.

For the reasons already stated above, Applicants respectfully submit that Forrest I does not anticipate Applicants' claims. Moreover, the Examiner stated that "[t]he first electrode can be an anode, which tends to be very rough, and induce protrusions in the deposited first layer." Sept. 7, 2006 Office Action para. 12. Applicants submit that, for the reasons stated above, these "protrusions" do not teach the bulk heterojunction disclosed and claimed by Applicants herein.

Applicants respectfully submit that the rejections under 35 U.S.C. § 102 have been overcome and should therefore be withdrawn.

V. REJECTIONS UNDER 35 U.S.C. § 103

Claims 6 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Foust in view of United States Patent No. 6,337,102 ("Forrest II"). Claims 7, 12-16, 22, and 27-32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Foust in view of United States Patent Publication No. US 2003/0042846 ("Forrest III"). Claims 20 and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Foust in view of United States Patent Publication No. US 2002/0197462 ("Forrest IV").

In order for a claim to be rejected for obviousness under 35 U.S.C. § 103(a), not only must the prior art teach or suggest each element of the claim, but the prior art must also suggest combining the elements in the manner contemplated by the claim. *See Northern Telecom, Inc. v. Datapoint Corp.*, 908 F. 2d 931, 934 (Fed. Cir. 1990), *cert. denied* 111 S.Ct. 296 (1990); *In re Bond*, 910 F. 2d 831, 834 (Fed. Cir. 1990). The Examiner bears the initial burden of establishing a *prima facie* case of obviousness. *See* M.P.E.P. §2142. To establish a *prima facie* case of obviousness, the Examiner must show, *inter alia*, that there is some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the references and that, when so modified or combined, the prior art teaches or suggests all of the claim limitations. *See* M.P.E.P. §2143. Applicants respectfully submit that a *prima facie* case of obviousness has not been established in regard to the currently pending claims.

As described above, neither Foust nor the Forrest II, III, or IV references teach or suggest a bulk heterojunction. Thus, Forest II, III, and IV do not cure the shortcomings of Foust or the Forrest I reference, as discussed above, namely that these references do not teach or suggest a bulk heterojunction.

Thus, for at least the same reasons stated in the previous section, Applicants respectfully submit that the rejections under 35 U.S.C. § 103 have been overcome and should therefore be withdrawn.

VI. INTERVIEW SUMMARIES

The Applicants thank the Examiner for the courtesy extended during a phone conversation with Kevin Godlewski on July 12, 2006. During the interview, the following was discussed:

- (A) No exhibit or demonstration was shown.
- (B) The discussion focused on the term “bulk heterojunction” as applied specifically to claims 1 and 17.
- (C) U.S. Patent Publication US 2004/0121508 to Foust et al. was discussed.
- (D) No amendments were specifically discussed.
- (E) The applicants argued that the term bulk heterojunction referred to an interpenetrating network of donor and acceptor materials as described in the specification.
- (F) It is not believed that other pertinent issues were discussed.
- (G) After consideration, the Examiner agreed that the term “bulk heterojunction” was improperly treated in the Office Action mailed April 19, 2006 and the Examiner notified Applicants that a new non-final Office Action would clarify the treatment of the term “bulk heterojunction.”
- (H) There was no e-mail communication.

The Applicants thank the Examiner for the courtesy extended during a phone conversation with Kevin Godlewski on September 14, 2006. During the interview, the following was discussed:

- (A) No exhibit or demonstration was shown.
- (B) The discussion focused on the term “bulk heterojunction” as applied specifically to claims 1 and 17.

- (C) No prior art references were discussed.
- (D) No amendments were specifically discussed.
- (E) The applicants argued that the term bulk heterojunction referred to an interpenetrating network of donor and acceptor materials as described in the specification.
- (F) It is not believed that other pertinent issues were discussed.
- (G) Upon further consideration, Examiner informed Applicants that the term “bulk heterojunction” was treated properly in the original Office Action mailed April 19, 2006. A second Office Action mailed September 7, 2006 was provided, which maintains the original treatment of the term “bulk heterojunction” as set forth in the Office Action mailed April 19, 2006.
- (H) There was no e-mail communication.

The Applicants thank the Examiner for the courtesy extended during a phone conversation with Kevin Godlewski on October 18, 2006. During the interview, the following was discussed:

- (A) No exhibit or demonstration was shown.
- (B) No claims were discussed.
- (C) No prior art references were discussed.
- (D) No amendments were specifically discussed.
- (E) There were no arguments presented.
- (F) It is not believed that other pertinent issues were discussed.
- (G) In order to clarify the record, the Examiner indicated that the Office Action mailed September 7, 2006 reset the statutory time period for filing a response to the Office Action

mailed April 19, 2006, such that the due date for filing a response to the Office Action(s) is December 7, 2006.

(H) There was no e-mail communication.

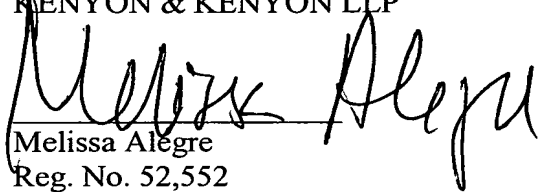
VII. CONCLUSION

Applicants respectfully submit that the pending claims are now in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number given below.

Dated: October 19, 2006

By:

Respectfully submitted,
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